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Dassault Systèmes' Powertrain Solutions Reducing Tail Pipe Emissions

Thanks to Dassault Systèmes' Powertrain Solutions, engineers can design and simulate engines that are at the same time eco-friendly, powerful, lightweight and reliable.

Today consumer expectations of more power as well as environmental norms require automotive companies to reengineer entire engine families. Considering that it takes an engine a minimum of 4 years to get to the market, it is essential that engineers make the right decisions early rather than lose millions of Euros scrapping prototypes containing design errors. An automotive manufacturer's competitive edge becomes synonymous with incorporating and validating the latest technologies, reducing costs and shortening cycle times.

From a business standpoint, automotive companies need to reduce the number of engines in their fleet. They also need to explore and validate more design alternatives in the same period of time to comply with stricter emission and noise regulations, and reduce the dependence on oil as a sole energy source.

POWERTRAIN SOLUTIONS ADDRESS THE DESIGN NEEDS

The Dassault Systèmes (DS) Powertrain Solutions are a suite of software, services and industry proven methodologies that address the unique needs of the powertrain industry. For example, powertrain engineers are often faced with the difficulty of integrating their very latest technologies and those provided by Tier 1 suppliers to reduce tail pipe emissions. DS' Powertrain Solutions improve supplier and OEM collaboration by providing the

latter with the tools that allow them to rapidly incorporate ideas and modifications to existing designs and even radically change an engine late in the development process without accepting compromises such as manufacturability or innovation.

Powertrain engineers typically need to reuse 50 to 70% of their previous engine specifications (functional and process) for new engine architectures. Thanks to CATIA V5, previous successful engine designs can be rapidly modified and therefore improved by easily capturing new emission reduction technologies.

DS' Powertrain Solutions also open the door allowing engineers to create engine functional designs in which their engineering specifications can be integrated directly into 3D using simple and robust techniques. Associativity between the detailed design, the functional design and simulation phases is ensured with knowledge-based template technology based on company specific know-how. Working in 3D in CATIA V5 also reduces costs by making it possible to design engines that can be digitally incorporated in different car models and validated on screen before the production of physical mock-ups thereby producing more viable vehicle configurations using the same engine.

Thanks to ENOVIA VPLM, engineers can also design in a fully configured context with real time availability of production data and verify, for example, critical behaviours related to the return

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of oil from the cylinder head to the oil pan or the flow of coolant throughout the engine when the engine is positioned at different angles depending on the vehicle – all in a digital environment.

INTEGRATING SIMULATION IN THE DESIGN PROCESS

When it comes to designing engines to meet strict emission constraints while maintaining acceptable performance levels, designers need tools to virtually simulate, in the early stages of the design, engine behaviour due to stress, mechanical resistance, flow of fluids in the engine or throughout the exhaust system, and cases related to vibrations or noise. All these constraints must be simulated before the engine is manufactured in order to foresee and correct potential problems that may arise in the final stages of a project.

These simulations are performed, on one hand, in the conceptual design phase where the engine is still at its early stages and where designers can perform short and rapid analyses to determine engine behaviour strategies and, on the other hand, in the detailed design phase

where more advanced tools provide a more in-depth analysis of an engine's behaviour. Using the CATIA V5 Analysis product solutions and the ABAQUS FEA software suite from SIMULIA, the Dassault Systèmes brand for realistic simulation, engineers have an array of simulation tools that cover the need for routine as well as complex non-linear analysis. Realistic simulation can, thus, become a controlled, collaborative, and integral part of their PLM process. For example, powertrain engineers use ABAQUS capabilities in non-linear thermo-mechanical FEA, to study the sealing properties of engines or gearboxes and to determine that the functionality of components is maintained under severe operating conditions.

Dassault Systèmes' Powertrain Solutions are the only PLM solution that integrates, in its design tool, all the analysis tools needed to simulate and to optimize the behaviour of an engine. Engineers can now base their designs on physically accurate analysis, well before the first engine is manufactured, thus saving significant cost for prototypes. As opposed to its competitors, Dassault Systèmes has opted for a fully integrated and multi-physics simulation approach where engineers can simultaneously take into account all types of analysis criteria such as thermal analyses, fluid dynamics analyses, durability and vibration. In this way, engineers are given the luxury of not having to make concessions when designing their engines.)

